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ABSTRACT

This study evaluated the effectiveness of the Pyramid method, an educational method for 3- to 6-year-olds. The Pyramid method seeks to improve young children's chances for a successful primary school career, particularly among ethnic minorities (of Turkish, Moroccan, Cape Verdian, and Surinam origins) and Dutch children of poorly educated parents. The study compared, over a 3 year period, the performance of a group of children participating in the Pyramid method to that of children in a control group. Findings indicated that the Pyramid method accelerated the development of children, both ethnic and Dutch, compared to the control group, with the greatest success when children entered the program in preschool. (Contains 41 references, 5 figures, and 4 tables.) (EV)

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**Pyramid, educational method for 3 to 6-year-old children
Theory and research**

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1

Summary

This article reports on a study of the effectiveness of the Pyramid method, an educational method for 3 to 6-year-old children. The three-year-olds in this population attend a pre-school playgroup; the 4 to 6-year-olds are the group 1 and 2 learners at the Dutch *basisschool*¹. The aim of the Pyramid method is the stimulation of pre- and early-school development in young children, particularly in ethnic children (more specifically those of Turkish, Moroccan, Cape Verdian and Surinam origin) and Dutch children of poorly educated parents. The intention of the Pyramid method is to improve these children's chances of a successful primary school career.

In this report a description will be given of the theoretical framework of the Pyramid method, and of its practical, implementational essentials - the play program, the project program and the tutoring program. The effectiveness of the method has been examined in an observational study. The experimental group was given Pyramid treatment. The control group consisted of the reference group of the monitoring system for preschool and kindergarten children, used in the Pyramid method. This system was the instrument for the longitudinal measurement of the effectiveness of the instruction offered to the children. The effectiveness was measured over a period of three years and the study itself was part of an external evaluation by Amsterdam University. The method was implemented by teachers, who were trained on site. Special teachers who worked as tutors in the experiment collected the research data every six months and informed the researchers about their findings.

The study shows that the Pyramid method is effective when results are compared to those of the reference group. The Pyramid method accelerated the development of the children taking part in the experiment - both ethnic and Dutch. The chance of success is largest when the children enter the program at preschool level and continue their participation in groups 1 and 2 of primary education. Children who start taking part in group 1 or 2 also benefit, but to a lesser extent. The Pyramid method is not only effective for risk groups, but also for children with a potentially successful primary school career. Extra investment in risk children does not have any adverse effect on successful children, who also benefit from the Pyramid method.

¹ A *basisschool* is a school for primary education for 4 to 12-year-olds. *Basisschool* groups 1 and 2 are the former "kindergarten" learners. In this study both terms are used to denote 4 to 6-year-old students.

1. Introduction

In 1994 the Dutch government was looking for educational programs, which would fulfill a number of criteria for the elimination and prevention of developmental delays. A meta-analysis of the effectiveness of preschool programs (Royce, Darlington and Murray (1982) and Leseman (1992)) suggested the following criteria:

- sufficient dosage (at least four mornings/afternoons a week)
- a reasonable period of intervention (two or three years)
- early starting age (two or three)
- favorable teacher-child ratio (1:12)
- parent involvement

The Meijnen committee (Leseman & Cordus, 1994) selected two educational methods, which fulfilled these criteria: the American High Scope program, developed by Weikart (Weikart & Schweinhart, 1991) and the Pyramid method, developed by Van Kuyk (1994, 2000b).

In Pyramid the criteria were fulfilled in the following manner:

- Pyramid is an intensive method for 3 to 6-year-old children, with special materials for ethnic and Dutch disadvantaged children;
- At least four mornings/afternoons of preschool a week for three-year-olds taking part in Pyramid, and five school days a week for 4 to 6-year olds (groups 1 and 2 of primary education);
- Children can enter Pyramid at the age of two and a half, if they do not need too much care and attention; the actual method starts at the age of three;
- There is a favorable teacher-child ratio. Children in need of additional stimulation are supported by a tutor (Slavin, Madden & Karweit, 1994; Karweit, 1984). The tutor is available four mornings or afternoons a week; a tutor's work is mainly preventive.
- Parent involvement is strong. The activities that parents engage in at home run parallel to the (pre)school activities.

In section 2 of this paper a description will be given of the theoretical foundation and the practical implementation of the Pyramid method.

Section 3 is a detailed description of the research on the effectiveness of the Pyramid method. This research was carried out between 1996 and 1999 as part of an external evaluation by Amsterdam University of the effectiveness of the two methods mentioned above - High Scope and Pyramid (Veen, Roeleveld & Leseman, 2000) - and a study at Groningen University of the implementation level of the two methods (Reezigt, 1999). In this observational study by Citogroup the effectiveness of the Pyramid method was examined with the help of the preschool and kindergarten child monitoring system, used in the Pyramid method (Van Kuyk, 1997, 2000a). This monitoring system will be described in detail in section 2.3.2.

In section 4 the research results will be discussed. They will be compared to the results of the reference group of the monitoring system, which is representative of the Dutch population and serves as a control group.

Research conclusions will be drawn in section 5.

2. The Pyramid method

2.1 Theoretical background

Pyramid is an educational method for 3 to 6-year-olds. It is based on theories that relate to the young child's early and preschool development.

In the Pyramid theory, education is the action of the adult who takes care of and protects the child on his/her route to independence (Deković, 1992). Education means staying close to the vulnerable child, which is not yet able to perform life's tasks on his or her own, at the same time encouraging him/her to move away from the adult, to explore the world, even if this involves a certain amount of risk. This paradox is the foundation for the Pyramid method, which rests on four concepts:

psychological nearness, psychological distance, child initiative and adult - or more specifically teacher - initiative.

Psychological nearness

Psychological nearness is the ability of the adult to make the child feel safe and secure. This concept is based on the attachment theory (Bowlby (1969), Ainsworth, Blehar & Waters (1978), Erickson, Sroufe & Egeland (1985)). It is the foundation for the pedagogical component of the Pyramid method. Nearness in the attachment theory starts off as the actual, physical nearness of the adult to the child, but soon physical nearness is replaced by psychological nearness - the developmental stage in which the simple awareness of the adult's nearness is enough to make the child feel safe. From a theory having its roots in the mother-and-child relationship, it is now rapidly changing into a theory for preschool and early school educational contexts (Van Lieshout, 1987, Riksen-Walraven, 1989). Psychological nearness is an essential condition for effective psychological distancing. According to Bowlby fear is like a thermostat: the thermostat starts working when fear grows. The full energy potential is needed to survive, to overcome fear. When the fear dies down, there is energy to explore, to separate him/herself from the immediate here and now.

Psychological distance

Psychological distance is the growing ability of the child to understand that an object (thing, person, idea, and the like) can be represented by something other than the concrete object itself. The concept of psychological distance is at the very heart of distancing theory (Sigel, 1970, 1993; Cocking & Renninger, 1993). This theory too has its roots in the mother-and-child relationship and one of its features is the identification of relationships with a positive developmental effect. The distancing theory is also used in studies in early and preschool education. By making representations the child learns to abstract from the immediate here and now. In principle the distancing theory can be applied to all developmental areas (Cocking & Renninger 1993, Mischel & Rodriques, 1993, Watson & Fischer, 1993).

Sigel (1993) identifies three distancing-strategy levels - a low, a medium and a high level of representation. The major importance of this theory is apparent from the large number of studies based on it. For Sigel it is a reason to conclude that 'low level distancing strategies do seem to function as depressors of representational competence, at least as measured by anticipatory imagery, memory, seriation and general ability', while high-level strategies have a positive effect on both mathematical orientation and early language development. This conclusion is the motivation for making the stimulation of high-level distancing strategies the starting-point for the didactical component of the Pyramid method.

Distancing is a two-sided process. On the one hand, the child has to be addressed close to his/her personal level of knowledge and experience. On the other, the child has to learn to create a distance and reach the highest possible level of representation.

Child initiative

In Piagetian theory (1970) the child has enough cognitive power to control his/her own development in the physical and social environment in which it grows up.

The child "grows" in play, in particular through exploring and playing with objects, on his/her own and with other children. In play the child is confronted with peer perspectives, which might be different from his/her own. A difference in views may lead to conflict situations, which can be very instructive, since they create a whole new balance in knowledge and skills. Studies of young child development and of free play show that it is not only child initiative that is important here; adult influences on child play are essential too. Child play does not automatically result in development, as Sigel (1982) explained in his distancing study, in which he emphasized the importance of the social mother-and-child interaction. Sylva (1992) has made it very clear that play will have no learning and developmental effects without the tutoring of parents or teachers. She also concluded, however, that child initiative and the active involvement of the child are very important elements too.

In the past ten years the constructivist method of learning has been winning ground. This is a method characterized by active construction, rather than passive absorption, and by using one's own experiences and learning to think for oneself. In the Pyramid method child initiative is essential, more specifically a child's own active involvement in play and learning activities. Adults, however, are important too; with their guidance and tutoring they can make child initiative a much more efficient and effective asset.

Teacher initiative

In the previous paragraph teacher initiative was introduced as an important element of the Pyramid method. Its importance is supported by the Vygotskian tradition (Vygotsky, 1962). It is through child-adult interaction that the child is introduced to his/her culture and learns to master all kinds of cultural and social skills. The interacting adults can show which skills are important and how they can be learned systematically and efficiently. What the child cannot do independently he/she can do with some adult help and assistance. In this context the notion of 'scaffolding' is used by Bruner (Bruner, 1995). Scaffolding is a metaphor for the idea that with the help of the adult, who is a kind of scaffold, the child can reach a higher level than would have been possible without it. Scaffolding may mean offering a prestructured and richer environment for the child to play in, but it may also mean structuring a task and explaining it to the child. In Pyramid the teacher offers the child the support he/she needs to get a grip of what he/she is doing: by joining in the activities, by suggesting a possible direction, by giving hints, by offering clear instructions and by (pre)structuring the task, but all of this in a manner which allows the child to learn actively and separate him/herself from the here and now (Sigel, 1993).

The importance of 'scaffolding' is confirmed in the dynamic system theory. This builds on the theories of Piaget and Vygotsky (Van Geert, 1998, Fischer & Bidell, 1998; Fischer & Rose, 1998). According to this theory, development can be stimulated by the teacher or tutor. Development is best characterized as a long series of cycles, taking place at increasingly high levels from birth to about 30 years of age. It is a variable and flexible system of changes, always occurring in two cycles: short- and long-term. These cycles do not occur spontaneously in whatever children and adults do. Usually people only function at their best with strong support from their environment (and this is where there is a role for a teacher or tutor). Without this support, learning and thinking will become weaker and will be restricted to the lower levels.

Fischer & Bidell (1998), for instance, have shown that stimulation of play or recounting activities leads to a higher level of thinking than activities that are not supported. The implication is that thinking and acting levels very much depend on the amount of stimulation offered by teachers or tutors. This support is the starting-point of the didactical component of the Pyramid method.

In short, the attachment theory is the foundation for the pedagogical component of the Pyramid method; the didactical component is based on the distancing theory. In the Pyramid method the child's own initiative is both starting-point and objective of the Pyramid method, but teacher/tutor stimulation of development - i.e. teaching the child to learn actively and on his/her own - is important too.

2.2. Method content

The Pyramid method covers three intelligence areas, related to what in education are called the gifts of the head (cognitive intelligence), the heart (emotional intelligence) and the hand (physical intelligence). They can be separated but they also affect one another. In Pyramid the multiple intelligence concept (Gardner, 1993) with a limited number of intelligences was opted for.

In these intelligences a number of developmental areas can be identified (Van Kuyk, 1987), see figure 1. According to Fischer & Rose (1998), connections are made between these developmental areas (also called developmental webs) in each cycle of growth. Skills develop separately first and then continue to connect to other developmental areas later on.

In Pyramid both the specificity of the activities in the developmental areas and the coherence between the various areas is taken account of.

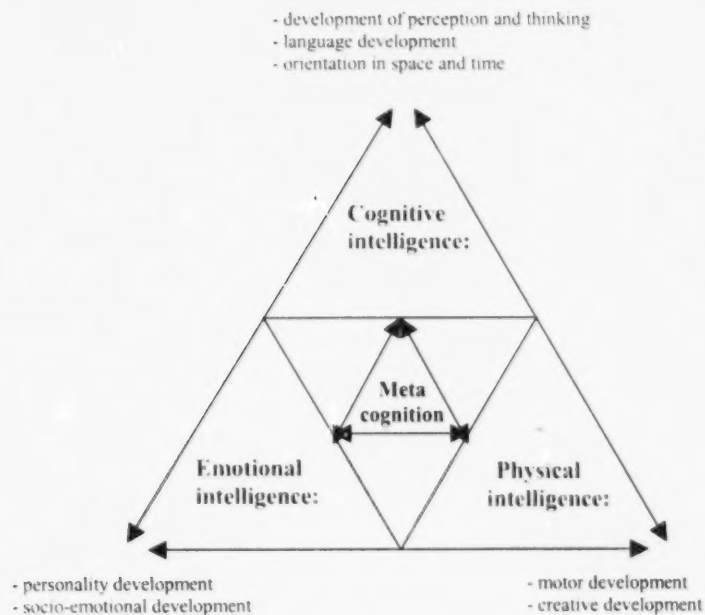


Figure 1. Intelligence areas and developmental areas in the Pyramid method

A more detailed description of the intelligence areas and the accompanying developmental areas is given below.

Emotional intelligence

Emotional intelligence is the ability to be receptive to one's own and other people's emotions and adjust one's social actions accordingly (Salovey & Mayer, 1990).

This intelligence area comprises the areas of personality development, which is intrapersonal, and socio-emotional development, which is interpersonal (see also Gardner, 1993). The child learns to be confident, to persevere and control him/herself, to be motivated and be curious when he/she plays or learns, alone or with other children. He/she also learns to identify and respect his/her own and other people's feelings and act accordingly.

Physical intelligence

Physical intelligence is the ability to make and control movements and be creative. In this area a distinction is made between motor development (intrapersonal orientation) and creative development (interpersonal orientation). In this area the child learns to move; he/she learns to act, control his/her body and explore his/her boundaries. He/she learns to be creative with his/her body and to express his/her body language. The child learns to use materials, tools and instruments, for instance in visual arts education and music; he/she learns to create new things with his/her body and with the help of materials and tools.

Cognitive intelligence

Cognitive intelligence is the ability to master language and thinking, and act accordingly.

This intelligence area covers the development of perception and thinking (intrapersonal orientation), language development (interpersonal orientation) and orientation in space and time. All action takes place in space and time. Through the development of these areas the child learns to be aware of his/her everyday environment. He/she learns to get a grip of this environment and to separate him/herself from the here and now. Language and thinking are particularly important instruments, and so are the concepts of space and time. The child learns to identify characteristics of the environment by making representations; he/she learns to solve problem, express him/herself in language and communicate with his/her environment. he/she learns to control him/herself, to reflect on and become aware of his/her own actions.

These three areas of intelligence each have their own specific characteristics, but they also show coherence - they influence and reinforce one another. Emotional intelligence, for instance, will give the child confidence. This in turn will enhance cognitive development and will allow the child to control his/her motor behavior. Conversely, absence of impulse control may disturb both motor and cognitive intelligence. Guided by cognitive intelligence the child may become aware of his/her physical, emotional and cognitive action and learn to deal with it in a flexible way. This awareness is called metacognition.

2.3 Description of the Pyramid method

The Pyramid method is based on the four elementary concepts and the three intelligence areas mentioned above (see 2.1 and 2.2 respectively), which have been translated into a pedagogical and a didactical component respectively.

In the *pedagogical* component a description is given of the necessary attitude on the part of teachers.

The teacher's attitude must be sensitive and responsive, creating a positive pedagogical climate for the child, in which the attachment theory can be safely put to the test (Riksen-Walraven, 1989).

This is done by:

- creating a safe environment
- offering the child emotional support
- refraining from negative remarks
- respecting the child's autonomy
- drawing lines and offering structure
- giving child-oriented explanations

The central element in the *didactic* component is the development of all children, which is stimulated by teaching them to separate themselves from the here and now (Sigel, 1993) - 'to deal with the nonpresent' (Copple, Sigel & Saunders, 1985) - at increasingly high levels of representation. Here a complementary educational model is being used. Teacher intervention keeps equal pace with the child's need for help and support. The didactic component has been translated, at various intervention levels (low, intermediate and high), into four programs which are at the heart of the Pyramid method: the play program, the project program, the tutoring program and the parent program.

2.3.1 The Pyramid programs

To give an impression of the coherence between the programs, short program descriptions will be given below. There are two types of play programs: a free play program and a structured, project-integrated play program. The projects all consist of a (structured) play program, a group program and a tutoring program. The tutoring, which is linked to the group program in the projects, can either be preventive or remedial. The parent program is linked to the play and project program.

Play program

In the play program the child can *play freely* and on his/her own initiative in a pre-structured rich *play-learning environment* and explore all developmental areas in all kinds of corners and special places. There is a home corner, an art corner, a building corner, a reading/language corner, a thinking/maths corners and, for the three-year-olds, a climbing corner, with various kinds of materials. There is also a *structured* play program which is part of the project program. In the play-learning environment the teacher creates new play situations, for instance by adapting the corners or creating new ones. Starting from a given theme, new impulses for rich play are given.

Here and in the following paragraphs the Water project serves as an example. In this project the home corner is turned into a bathroom. In the language corner there are all kinds of water-related pictures and a series of picture books from the library. In the sandpit in the playground all kinds of pans and buckets can be used to play with water. With each new theme corners are changed and new ones are made.

The child creates his/her own initiatives, plays with its peers and makes choices. Adult intervention level is low. When there is no richness in the activities, it is added by the teacher, who plays along with the child, offers new ideas, involves other children or keeps talking to the child. The intervention level is raised. When the child is not able or willing to play, the teacher teaches him/her to play. The intervention level is high, but the ultimate aim is to foster independence in the child, so that he/she will start creating initiatives. The teacher shows how to play to inspire the child, and slowly retreats when the child accepts the challenge.

Offering rich play and learning how to play are parts of the ability training given to the teachers in the implementation stage of the Pyramid method.

Project program

A project is a well-balanced set of play and learning activities covering a specific developmental area, but with some input from the other developmental areas. The activities are built around a theme. A network of notions in different clusters gives the project theme its coherence. A project is described in a project book of 80-100 pages and includes a *play program*, a *group program* with processing and a *tutoring program*. There are twelve projects in a year, one for every 3 to 4 weeks, each preceded by a welcoming program. The annual programs of three consecutive years are characterized by clear structure, strong coherence and uninterrupted line of development.

The play program of the projects was described in the previous paragraph. The group program includes activities for the exploration of a subject outside the classroom. Generally the teacher introduces the outside world into the classroom with lots of concrete materials and pictures, and explores this world with the children at increasingly high levels of representation. Some examples of materials used in the Water theme: objects which can hold water, a fountain, plantsprays, measuring jugs, but also a water table with water table objects, musical instruments to imitate water, paper clouds and paper water drops, books about water, large water identification pictures, CDs with water songs and water sounds, in short materials representing a number of developmental areas.

There are also development materials, which offer the possibility of taking an intermediate step, which bridges the gap between reality and abstraction. The group exploration, an activity taking part on a daily, 30-minute basis, consists of four steps, which are based on Sigel's distancing strategies (Sigel, 1993). Each step covers some 5 activities, from which the teacher can make a selection or to which activities can be added. Teachers can also use an idea presented by a child as a starting-point and work it out. In each step there are a number of vocabulary activities, to give extra support to the ethnic children. The first steps of the group program start very close to the child with concrete materials and in the more advanced steps the distance grows.

These are the steps in the group program:

Orientation

In this step the child is introduced to the *atmosphere* of the *theme* and its context. With the help of very concrete materials the project starts *close to the here and now*. In the Water project, for example, the water table is put in the classroom and filled with water. All kinds of water-related materials (and their use) are discussed, songs about washing your hands are sung or a story is told about two children arguing about doing the dishes.

Demonstration

With all its senses the child learns to develop a stable knowledge, *as close to experience as possible*. *Clear examples* teach the child to *identify and represent relevant features*. One of the ways in which the teacher can introduce the exploration stage is through the sense of feeling: (in the Water project) having the children experience what drops of water feel like and having them experiment with hot and cold water in various trays. The children experience the sensations and discuss them together. Taste and smell are introduced as well: what does the water smell like, what is the taste of water? But water is also a substance to be looked at: water can be clear or muddy, and how can muddy water be made clear again? And finally the children listen to water.

What do you hear when you move your hands through the water or pour out something? In Deepening, one of the later stages of the project program, the children also learn to switch from one sense to the other: you see it is raining, what do you feel when you are outside in the rain?

Broadening

The child is taught to *identify relevant features in a number of (self-introduced) examples*. Her/she learns to separate him/herself from the here and now by using his/her own *experiences* and learns to *connect new representations to his/her own level of knowledge*. He/she learns to identify *similarities and differences*, also in things and situations which are not present. Some examples from the Water theme: water-filled objects - what are they used for? What are the similarities and differences? For example: what is a plant spray used for? And a watering can? The children see how these objects work and all kinds of questions are asked: what is the same and what is different? How does this happen outside, in nature? If possible, the children go outside to explore a subject together. Afterwards they can discuss their own experiences, with the help of picture books, identification pictures, a water song, and the like.

Deepening

The children learn to *implement* what has been taught *in new situations* and use the *experiences of the teacher* and others. They learn to *anticipate* situations, *solve problems* and *reflect* on problem situations. Examples: the children experiment with clear and muddy water and think about how dirty water can be made clean again and how clean water becomes dirty. They experiment with the notion of floating, and sort floating and sinking objects. They deal with problems like: you cannot see it but it is there (salt or sugar being dissolved in the water). How do you know there is salt in the water? In Deepening the children learn to handle *discrepancies and things that are not possible*, but they also learn to *be flexible when dealing with all kinds of different representations*; making a shower work, drawing running water, experimenting with different water heights in the sandpit.

Processing

The group program is followed by a processing stage, in which all kinds of activities take place - collective activities with movement and music, like playing on a water-bottle Glockenspiel, but also playing with graphic notations of water sounds or making waves. There are activities in which children play and work with development materials or do assignments. There are also creative activities, in which the children make fish for the fish task with all kinds of materials and techniques: drawing, cutting, sawing hard plastic, et cetera. A number of processing assignments is characterized by a hierarchical structure (e.g. language, thinking and fine motor skill activities). The various developmental areas are given an all-round treatment here. For a more detailed description see Van Kuyk, (2000a).

Tutoring program

The tutoring program is based on and related to the group program and is included in the project books. There are two kinds of tutoring: preventive and remedial. Preventive tutoring is offered on an individual basis, prior to the group program. In preventive tutoring children are made familiar with each of the project steps in the group program. Children needing some extra learning time are given remedial tutoring at the end of the project activities.

A difference with the group activities is that the tutoring activities generally have two or three levels. There is one basic activity, which can be simplified or made more difficult. In the

Demonstration part of the Water theme, for instance, the child experiments with the features of water by feeling and describes what he/she feels when an object is wet or dry. In the easier version the teacher describes what the child is doing and feeling.

In the more difficult version the teacher asks the child to close his/her eyes and describe what he/she feels when he/she touches wet and dry objects. This helps to differentiate the tutoring to match the needs of the child.

In the play program of the projects the intervention level is low. Of his/her own accord the child responds to the new impulses provided by the new play context of a theme.

In the group program there is medium intervention. The teacher and the children explore the theme together.

In the tutoring program the intervention level is high, because of the individual support and counseling.

Parent program

The parent activities have strong links with the play and project activities. Every morning the parents can play with their children in the classroom, in a rich play-learning environment. Parents are informed in each project about the theme, if necessary in their own language: in the project books all important notions from the notion network have been translated into four languages.

There is a discovery table in each classroom at which the children can play and which immediately makes it clear to the parents what the theme is, so that they can join in. Parents are given ideas about how they can play and work with their children at home. As part of the water theme they can do the dishes together, talk about water when the child is in the bath or when dinner is being prepared in the kitchen. The child can perform activities him/herself. There are also activities in the child's own language and culture, taught by a special teacher to children of ethnic origin. These activities are linked to the projects and give the program its coherence.

A more detailed description of the Pyramid method theory and practice is given in the Implementation book (Van Kuyk, 1998).

2.3.2. Child development monitoring

Longitudinal child development monitoring calls for high-quality teachers, carefully observing their students on a day-to-day basis, with the help of observation lists (for instance to check the degree of richness in the child's play). Twice a year the various developmental aspects are measured with the help of the preschool and kindergarten child monitoring system, mentioned in the introduction (Van Kuyk, 1997, 2000a). This helps the teacher take longitudinal decisions, over a period of three years, about the educational route to be taken. The monitoring system is also used to single out children for tutoring and to determine the effectiveness of the educational method and content. This section will focus on the description of the preschool and kindergarten child monitoring system, which is also used as an instrument to establish the effectiveness of the Pyramid method.

The preschool and kindergarten child monitoring system (see also section 3.2) consists of a number of tests and observation scales for preschool and kindergarten children. Cognitive intelligence (language development, development of perception and thinking, orientation in space and time) is measured in the tests.

The observation scales measure emotional and physical intelligence (personality development, socio-emotional development and development of motor skills, creativity, and work-play behavior). The tutor, the teacher for children who need some extra stimulation, tests the preschool children on an individual basis. The group 1 and 2 tests are taken in small groups. Children who belong to the 25% lowest score group on at least two of the three tests, are eligible for tutoring. In the tutoring process the information from the observation scales is used as a guide.

3. Research theory and practice

To examine the effectiveness of the Pyramid method for 3 to 6-year-old risk children who need some extra development stimulation, a quasi-experimental study was carried out (simultaneously with the High Scope program). This quasi-experimental study covered a period of three years (1993-1996). In this experiment another effectiveness study was conducted by Citogroup (Van Kuyk, 2000b)². This Citogroup study was an observational study. The experimental group was given the Pyramid treatment. The reference group of the preschool and kindergarten child monitoring system was used as a control group.

In the Citogroup study the following two questions are answered:

1. Can the Pyramid method help stimulate the development of the children from the experimental group to such a degree that their results are better than the control group's results?
2. Can the Pyramid method help reduce the percentage of risk children and increase the percentage of children with a potentially successful primary school career?

The experimental group, which will be described in more detail in section 3.1, consists of a group of Dutch and ethnic children, a large percentage of whom, at the start of the experiment, is considered to be in the category of risk children who will probably not have successful primary school careers. A risk group is a group of children with the 25% lowest scores on the norm scale of the preschool and kindergarten child monitoring system used in the experiment. The other 75% are expected to be successful at primary school. The percentage of successful children in the experimental group is taken to be considerably smaller than 75%.

The control group in the Citogroup study was the reference group of the Citogroup preschool and kindergarten child monitoring system, mentioned above.

Prior to the experiment the preschool and kindergarten child monitoring system was tested for its psychometrical qualities and standardized with the help of a reference group. This reference group is representative of the Dutch population of 3 to 6-year-olds attending preschool and the first groups 1 and 2 of primary school. The reference group was monitored in a longitudinal standardization study, in playgroups where a non-Pyramid preschool program was taught for a year and in the first two groups of primary schools without the application of the Pyramid method

The results of the experimental children are compared to a norm scale of the preschool and kindergarten child monitoring system used in the study, which includes 5 ability levels. The children of the levels A, B and C are considered to be potentially successful in primary education. The D and E level children are the risk group children. The E children are the high risk children; they are the ones most likely to have unsuccessful school careers.

² Citogroup is an organization more or less comparable to the Educational Testing Service in Princeton. One of its many tasks is the development and validation of tests which are used in Dutch education.

The different levels have been defined as follows:

- A: 25% highest scoring children
- B: 25% above average scoring children
- C: 25% below average scoring children
- D: 15% above lowest scoring children (risk children)
- E: 10% lowest scoring children (high risk children)

In research question 1 the criterion is a development which is faster than in the ability levels of the reference group. The hypothesis is that children being taught the Pyramid program will be stimulated in their development and will catch up with their peers, helped by an acceleration in their development. Children belonging to the group of the 25% lowest scoring children and therefore being most at risk of having problems in primary education, will be given additional and intensive learning time by a tutor (an average four times 15 minutes a week), to stay out of the risk zone.

The investment in risk children such as ethnic children and Dutch disadvantaged children, who generally fall into the 25% risk category, may, however, never be harmful to the children in the Pyramid groups with a potentially successful primary school career, who generally fall into the 75% highest scoring group of the population.

Consequently the criterion for research question 2 is: at the end of the experiment the percentage of risk children should not exceed the percentage of the reference group (25%) and the percentage of successful children should not be smaller (75%).

3. Research

3.1 Experimental group

The experimental group was selected by a committee, especially appointed for the purpose, the Pre- and Early School Education Committee (Van der Ley, 1996). For an answer to research question 1 three experimental groups, or clusters, were monitored:

- cluster I, N=49, the group taking the full experimental route from the 0 measurement at the start of playgroup till the end of group 2 of primary education (PPJJOO);
- cluster II, N=230, the group taking the experimental route from the 0 measurement at the start of group 1 of primary school (JJOO);
- cluster III, N=301, the group taking the experimental route from the 0 measurement at the start of group 2 of primary school (OO).

The clusters mainly consist of Dutch, Turkish and Moroccan children. The 'other' category represents other nationalities of which there were many.

Table 1. Experimental group structure

Experimental clusters	N	% Dutch	% Turkish	% Moroccan	% Other
Cluster I (0 meas., PPJJOO)	49	62	20	4	14
Cluster II (0 meas., JJOO)	230	49	20	11	20
Cluster III (0 meas., OO)	301	42	19	12	27
Total	580	46	20	11	23

The three clusters differ in the length of the treatment given (3 years, 2 years or 1 year, respectively) and in the composition of the group.

Cluster I has relatively more Dutch children than clusters II and III. In this respect the differences between the clusters are not significant: $X^2=10.94$, $df=6$, $p=.09$.

There is also a difference in the intensity of the treatment. Some children in each cluster, most of whom are of ethnic origin, are taught a tutoring program as part of the regular program.

These are mainly the 25% children with the lowest scores on two tests of the preschool and kindergarten child monitoring system (for an indication see the percentages of table 3).

There is a large difference in the number of children in the clusters because children do not automatically proceed from playgroup to primary school where the Pyramid method is taught in both. This makes cluster I relatively small.

To answer research question 2 a different group composition was opted for, to accommodate as many experimental children as possible. To this end all experimental children who had been tested at least once, were put together; a separate group was created for all children who had been tested seven times.

Seven is the maximum number of test administrations in the experiment. This means that all children who have been tested seven times have had the full three-year treatment. Children tested only once, have had no treatment. Therefore we can safely say that both groups are comparable and only differ in treatment.

The group of children who have been tested once, may include children who have had the full treatment, but also children who have only taken the final measurement of group 2 of primary school or those who have only had the first playgroup test and then left playgroup.

Children who have been tested seven times may have had different treatments. They may be children who, after the preschool 0 measurement, have attended groups 1 and 2 of primary school (PPJJOO), but also children who have attended playschool twice and then went on to group 1 of primary education (PPPPJJ) or children who attended group 1 or group 2 twice (PPJJJJ or JJOOOO respectively).

This format allows a maximum number of experimental children having had no treatment at all to be compared to children having had a maximum three-year treatment.

The percentage of Dutch children in the no-treatment group is smaller than in the group having had a three-year treatment. The percentage of Moroccan and other children is higher. The difference between the groups is significant here at 5% level: $X^2=9.76$, $df=3$, $p=.02$.

Table 2. Experimental groups in research question 2: no treatment or three-year treatment

Experimental groups	N	% Dutch	% Turkish	% Moroccan	% Other
Children tested 1x (no treatment)	534	34	20	18	28
Children tested 7x (three years of treatment)	185	46	20	15	19

Note: the percentages of children of different origin differ between the two questions. The teachers and tutors involved in the experiment have had twenty days of training, distributed over the three years of the experiment. Transfer of knowledge, ability training and the exchange of practical experience were the most important elements of these training sessions (See also Reezigt, 1999).

3.2 Instruments

In the experiment the Citogroup preschool and kindergarten child monitoring system has been used (Van Kuyk, 1997, 2000b). In the standardization study the Item Response (IRT) model has been used (Eggen & Sanders, 1993). This model differs from the classical test theory in many ways. In the IRT theory the notion or trait to be measured is central and the response to an item is considered to be an indicator of the degree of presence of this trait.

The relationship between the trait and the item response is probabilistic and represented in the so-called item response function, which indicates how much chance there is of a correct response as a function of the underlying trait or skill. The preschool and kindergarten tests can be put on one measuring scale, so that the children can be monitored every half year and longitudinally (over a period of three years). Use is made of the One Parameter Logistic Model (Verhelst, Glas & Verstralen, 1993). In the reference group the reliabilities of the tests in the classical sense are invariably: alpha > .80. Language: alpha = .82-.89, Ordering: alpha = .81-.86.

In this study the developmental areas of language and thinking were central and the following tests were used:

- Language for preschool children: vocabulary; critical listening
- Ordering for preschool children: notions of color, shape and size; classification
- Language for kindergarten children: vocabulary; critical listening; rhyming; orientation on the written word; auditive synthesis
- Ordering for kindergarten children: notions of color, shape and size; classification; seriation; comparing; counting; numbers

3.3 Data analysis

To be able to answer the two research questions introduced above the following data analysis was carried out. The results of the experimental children have been compared to the norm scale of the preschool and kindergarten child monitoring system used.

The five ability levels are represented in figure 2.

The E level children are the high-risk children (much chance of unsuccessful primary school careers); the D-level children are the risk children (some chance of not being successful in primary school).

In figure 2 an example is given of a scale, the Language scale, with which children can be monitored over a period of three years and the results of which can be compared to the five ability scales of the reference group. These scales were used in the answer to the first research question.

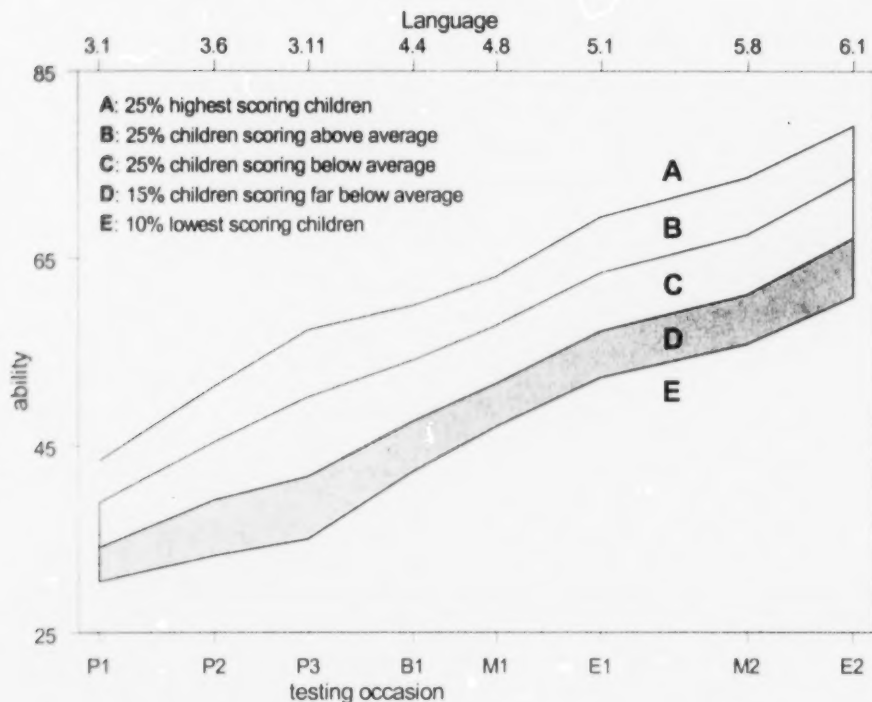


Figure 2. Language scale. Scale with five ability levels, for indicating individual and group achievement.

At the top: the average ages of the children of the reference group, that correspond with the testing occasions. Ability is indicated vertically.

Figure 2 shows that 3-to-6-year olds may be tested seven times, three times in preschool (P1, at the age of 3; P2, at the age of 3 1/2 and P3, at the age of 4), twice in group 1 (Middle (M1) and End (E1)), and twice in group 2 (Middle (M2) and End (E2)). Children who enter primary school at the start of the school year and who have not had any preschool tests, are given a starter's test (B1) in September. The tests are separated by six biannual periods, in which the Pyramid method is taught, which brings the total Pyramid teaching period to three years. Every half year the tests are taken and the results are compared to those of the reference group, to establish whether the progress of the children in the experimental group is faster than that of their peers in the reference group.

To answer research question 2 the results of the experimental children who had been tested once (no treatment) and the children who had been tested seven times (three years of treatment) were compared to the five ability levels of the reference group. To visualize the results cumulative histograms were used.

4. Results

4.1 Research question 1

Figures 3 and 4 indicate the results of the three experimental clusters, compared to the reference group. Here the average ages of the experimental cluster at the testing occasions were taken as a starting-point, instead of the testing occasions themselves.

This is why some of the ages of the older children are outside the scale. Figures 3 and 4 represent both the average ability of each cluster and the dispersion of the ability in a cluster at the various testing occasions. The horizontal lines represent the average ability; dispersion is represented by the vertical lines (See the end of this paragraph for an explanation of Dispersion).

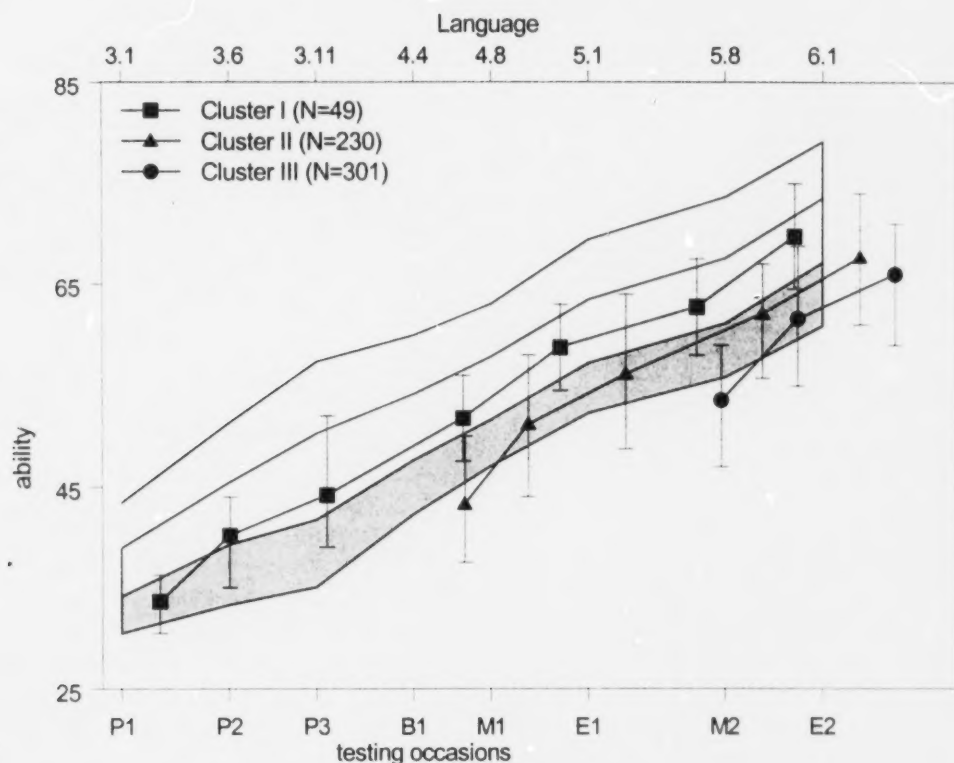


Figure 3. Results of the average abilities of the three experimental groups for Language compared to the ability levels of the reference group.

Average ability

Figure 3 indicates that at the start of the experiment the average ability of Cluster I is at D level, far below the average of the reference group, which is between C and B. In the cluster I children development is faster, right from the start, than in the reference group children.

In group 1 of primary education the development is similar to that of the reference group and at the end of group 2 the cluster I children again develop faster than their reference group peers. Their average end result is a high C level. At the first measurement the difference between the means of the reference group (N=474) and of the cluster I experimental group (N=49) (PPJJOO) is 38.9 and 33.6 respectively. The difference is significant at .05-level, $t=4.83$. The difference between the means at the end of group 2 is 73.5 (N=785) and 69.7 (N=49) respectively. Here too the difference is significant at .05-level, $t=2.56$. At the start of the experiment the difference between the means is large, but at the end of the three-year experiment the difference has been reduced considerably. Cluster II and Cluster III show fast initial development too. The development keeps growing, but after a while it slows down. Both clusters end at a high D level.

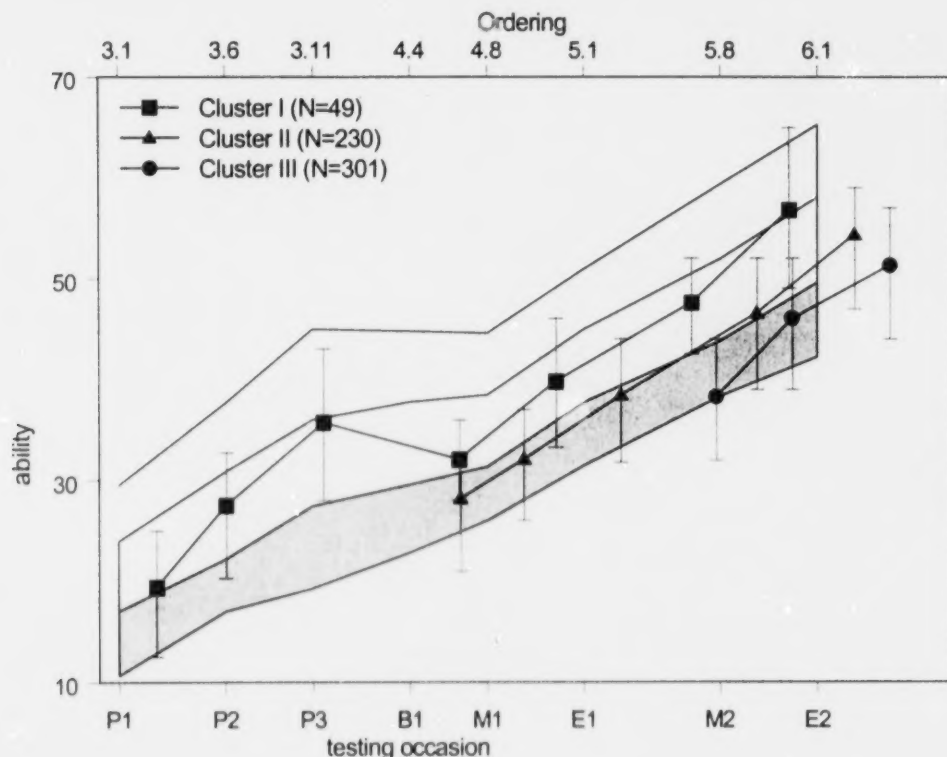


Figure 4. Results of the average abilities of the three experimental groups for Ordering compared to the ability levels of the reference group.

Figure 4 indicates the Ordering results.

Cluster I starts with an average on the border between levels D and C and shows a powerful development in preschool compared to the reference group, but there is also a "drop" at the start of group 1 of primary school. This drop might be an artifact of the administration procedure. The preschool tests are administered individually, whereas the group 1 and 2 tests are taken in small groups. Combined with the level of difficulty of some of the more abstract assignments in the Ordering test of group 1, this might have resulted in the drop. Then the results go up again, especially at the end of group 2. Cluster I ends at a low B level, near the reference group mean.

At the first measurement the difference between the reference group (N=440) and the Cluster I experimental group (N=49), (PPJJO) is 23.9 and 19.4 respectively. The difference is significant. The t-value is 2.97. The difference at the end of group 2 is 58.0 (N=799) and 56.8 (N=49) respectively. Here the difference is not significant, $t=.67$. At the start of the experiment there is a substantial difference between the means, but at the end of the three-year experiment the difference has been reduced considerably and the mean of Cluster I almost equals the reference group mean.

Cluster II starts from a slightly lower position than the average level reached by Cluster I at the start of group 1. Cluster II starts in the center of level D and rises steadily compared to the reference group. Cluster III starts at a low D level and rises very strongly but its development is slightly reduced towards the end.

Dispersion

It is also possible to look at the dispersion of the results of the experimental clusters. This dispersion is indicated by a vertical line above and below each mean. The end of the vertical line above a mean indicates a 75 percentile in the ability distribution, or in other words in 25% of the children ability scores are higher and in 75% scores are lower.

The end of the vertical line below the mean indicates a 25 percentile: 75% has a higher score and in 25% of the children scores are lower.

The implication is that the results of 50% of the children in a cluster is in between the top and bottom line.

Table 3

Percentages of D+E risk children of clusters I, II and III at the start and finish of the experiment and the difference between these two percentages. The start and finish percentage is also compared to the D+E percentage (25%) of the reference group.

Language	N	Start	Ref.group	End	Difference
Cluster I	49	75 %	25 %	25 %	50 %
Cluster II	230	75 %	25 %	50 %	25 %
Cluster III	301	85 %	25 %	70 %	15 %
Ordering		Start	Ref.group	End	Difference
Cluster I	49	50 %	25 %	20 %	30%
Cluster II	230	60 %	25 %	40 %	20 %
Cluster III	301	75 %	25 %	60 %	15 %

Table 3 indicates that at the start of the experiment the percentage of risk children in Cluster I is large and this is also true for Clusters II and III. However, if we take a look at the percentage of risk children at the finish, a large reduction of approximately 50% is found for Cluster I, a reduction of approximately 25% is found for Cluster II and in Cluster III there is a reduction of approximately 15%.

There is a similar picture for Ordering. Here, however, the percentage of risk children in Clusters I and II is considerably lower at the start, 50 and 60% respectively. Here too there is a stronger reduction of the percentage of risk children in Cluster I (30%) than in Clusters II (20%) and III (15%). The percentage of risk children in cluster I has dropped to reference group level, or below. In Language, where the percentage of risk children was high, there is a strong reduction to reference group level. In Ordering the percentage of risk has dropped below reference group level at the finish.

The longer the participation of the experimental group in the Pyramid project, the lower the percentage of risk children.

This means that the answer to research question 1 (about the possibility of experimental children being stimulated in their development) is: children who start in preschool (cluster I) and continue to take part in the program in groups 1 and 2 of primary school, develop much faster in language and thinking than the children in the reference group. All three clusters benefit from the Pyramid method, in development of language and thinking, but the group that starts in preschool benefits most and has the best starting position for a successful primary school career. With the help of the Pyramid method the percentage of risk children can be reduced considerably, provided participation starts early and continues longer.

4.2 Research question 2

The experimental children have been divided into two different groups: children who have been tested once (no treatment) and children who have been tested seven times (three years of treatment). A comparison of the cumulative percentages of the first measurements in figure 5 and the cumulative percentages of the reference group immediately shows that, at the start of the experiment, the percentage of risk children exceeds the 25% by far. In Language the percentage is 66%, in Ordering it is 56%. Consequently the percentage of successful children is considerably lower than 75%. The percentages are 34% and 44% respectively. The percentage of risk children is highest in Language, where the percentage of E children is a strikingly 44%, while in the reference group it is only 10%. This high percentage can be explained by the large number of ethnic children in the experimental groups.

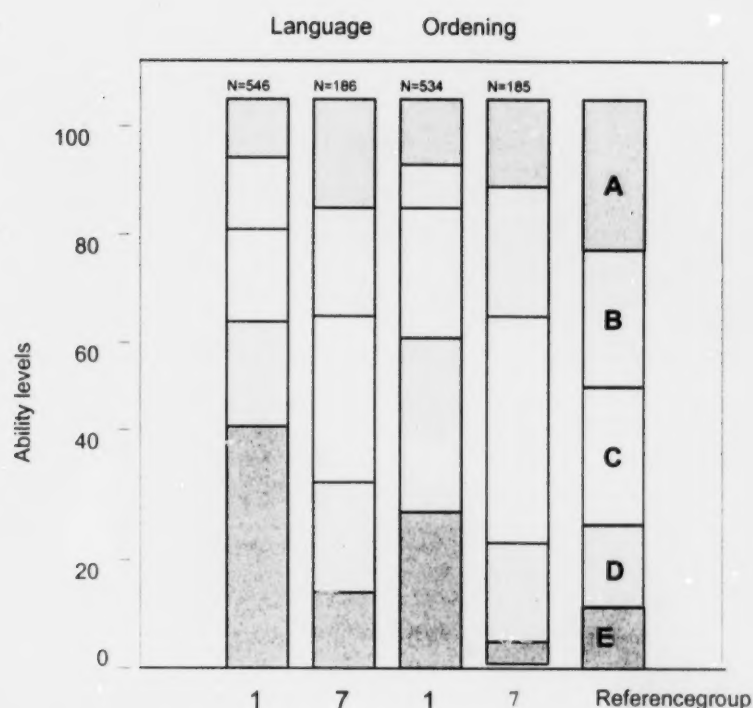


Figure 5. Cumulative histograms of the distribution of ability levels of measurement 1 (no treatment) and measurement 7 (three years of treatment) for Language and Ordering.

Table 4

Testing of the difference between the D+E and E levels of measurement 1 (no treatment and measurement 7 (three years of treatment) and between the D+E and E levels of the reference group and the D+E and E levels of measurement 7 (three years of treatment). The level of chance error is $< .01$.

Language				
Risk groups	% meas. 1	Ref.group	% meas. 7	chance
D + E	66		37	.000
E	46		14	.000
D + E		25	37	.0003
E		10	14	ns
Ordering				
	% meas. 1		% meas. 7	chance
D + E	56		22	.000
E	26		04	.000
D + E		25	22	ns
		10	04	

Figure 5 shows the results of the Language and Ordering tests compared to the ability levels of the reference group.

Table 4 indicates the testing of the difference at D+E and E levels between the group which has been tested once and has had no treatment and the group which has been tested seven times and has had three years of treatment. The group that had been tested seven times (three years of treatment) was then compared to the D+E and E levels of the reference group. For both Language and Ordering there is a strong decrease in the percentage of risk children at the seventh test. In Language the D+E level drops from 66% to 37%. Although there is a significant difference, the level of the reference group is not reached; the difference remains significant, but we must not forget that E children turn into D children.

In Ordering the percentage of risk children drops from 56% to 22%. The difference is significant.

In Language the number of high-risk children drops from 46% to 14% (a 32% drop). Here too the difference is significant. The E level almost equals the reference group's level. The difference is not significant.

In Ordering there is also a very strong reduction of the percentage of children running a very high risk of not being successful at primary school. The percentage of E-level children drops from 26% to 4%. The difference is significant. This percentage is significantly lower than the reference group percentage.

A closer look at the Language abilities of the C, B and A levels reveals a percentage of 34 at the first measurement and a percentage of 64 at the seventh: a 30% increase. It is not just the percentage of C children that rises, but more in particular the percentage of B and A children. In Ordering the percentage of C, B and A children has risen even more. At the first measurement the percentage is 43, but after the seventh measurement it has risen to 79, a 35% rise, a percentage which is even higher than the 75% of the reference group. It must be noted, though, that the percentage of C children has grown much more than the percentages of B and A children.

Summarizing, it may be stated that at the start of the Pyramid experiment the percentage of risk children in the experimental group exceeds the percentage of risk children the reference group by far. The percentage of successful children is considerably lower than in the reference group. At the end of the experiment the percentage of risk children is considerably lower and the percentage of successful children considerably higher. Research question 2 can therefore be answered affirmatively: the introduction of the Pyramid method has resulted in a considerable reduction of the percentage of risk children and a considerable increase of the percentage of successful children. In Ordering the percentage of risk children is even lower than the percentage in the reference group.

5. Conclusions and discussion

Two conclusions can be drawn from this experiment on the effects of the Pyramid study. The introduction of the Pyramid method results in a development which is faster than the development taking place in the control group (the reference group), to the extent that ethnic and Dutch developmentally delayed children, on average, have a chance of a successful primary school career.

The chance of success is largest when children enter the Pyramid program in preschool and continue their participation in groups 1 and 2 of primary school. Children who do not take part in the Pyramid method until group 1 or group 2 of primary school benefit too, but there is a smaller decrease of the percentage of risk children and they do not reach the level reached and maintained at the end of group 2 by children who entered Pyramid in preschool. The children's development can be stimulated even more with the help and support of the teacher and tutor, as is suggested in the dynamic system theory, the theory underpinning the Pyramid method (Fischer & Rose, 1998, Van Geert, 1998).

The second conclusion is that the Pyramid method not only strongly reduces the percentage of risk children but also increases the chances of success for a large number of children. The Pyramid method with its Distancing concept (Sigel 1970, 1993), which is the basis for the play program, the project program, the tutoring program and the parent program, proves to be effective, both for children in playgroup and for children in primary school, a confirmation of Sigel's conclusion, which was quoted in the early paragraphs of this study. The method is effective for all ability groups and is strong where it should be strong: that is, in the reduction of the percentage of children in the area where they run a risk, the bottom 25% of the reference group. The extra stimulation which children need is provided in a very effective manner and the children who are not at risk, do not suffer from this help. On the contrary, they profit as well.

This means that it is attractive to start the Pyramid method in preschool and continue implementation in the first two years of primary education. These results correspond with what the analyses carried out by Royce, Darlington and Murray (1983) and Leseman (1992) have shown: that it is essential to make an early start with an intensive program, which covers a long period of time (three years) and has a favorable teacher-child ratio (in the Pyramid method represented by the tutoring element).

The results also correspond with the results of the external evaluation studies of the Amsterdam and Groningen Universities.

The Amsterdam University effect study (Leseman, Veen, Triesscheijn & Otter, 1999; Veen, Roeleveld & Leseman, 2000) indicates that children playing and working with the Pyramid method have significantly better scores than their control group peers being offered another educational program in preschool and groups 1 and 2 of primary education. Both language and thinking development scores of the experimental children are better.

The Groningen University implementation study (Reezigt, 1999) shows that the Pyramid method has been implemented at a very high level. Compared to their peers in the control group the Pyramid children play and work in a better learning environment; they communicate better with their teacher and they are much more involved than their control group peers.

In the latter study some critical remarks are made as well. More attention is demanded for the language component and for the more difficult steps of Broadening and Deepening in the projects. Unfortunately it was impossible to respond to these critical remarks in the experiment itself. Practical experience and practical testing having revealed the need for the development of a special language line, there is now a third version of the projects (Van Kuyk, 2001). This language line was especially created for ethnic children and Dutch disadvantaged children and is an integral part of the play suggestions, the project steps and tutoring. Vocabulary extension activities have been added to both the project and tutoring programs. The project steps of Broadening and Deepening have been improved in the project books and in teacher and tutor training.

Active learning has been given a more prominent role - learning to anticipate new situations and learning to be aware of one's own actions (metacognition).

A well-structured, coherent and theory-based educational method such as Pyramid, in which play, projects, tutoring and parent activities interact in a creative setting, can make a major contribution to the effectiveness and quality improvement of pre- and early school education.

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